VISITORS' CLIMATE CHANGE BELIEFS & PERCEPTIONS OF CLIMATE-SENSITIVE RESOURCES AT GREAT SAND DUNES NATIONAL PARK

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Abstract
Ecological consequences associated with climate change are becoming increasingly noticeable in nature-based recreation areas. Research is therefore needed to better understand nature-based recreationists' perceptions of, attitudes towards, and behavioral responses to climate change and resource impacts in parks. This study explored strategies for assessing and responding to visitor perceptions of climate change at Great Sand Dunes National Park (GRSA), Colorado. In the summer of 2011, researchers intercepted visitors at GRSD and invited them to complete an online questionnaire. Visitors reported strong beliefs that global climate change was currently happening, but less certainty regarding the belief that human activities are influencing climate. Studies such as this may provide information for interpreters and park staff regarding climate change, and increase visitors' understanding of climate change. Future research could expand upon this exploratory study in an effort to inform resource management decisions and develop targeted climate change visitor education programs.

1.0 Introduction

Ecological consequences associated with climate change (e.g., speed of glacial recession, unprecedented storms and flooding, habitat range shifts) are becoming increasingly noticeable in nature-based recreation areas (Brownlee, 2012; NPCA, 2009). Collectively, these climate change impacts are beginning to affect the quality and enjoyment of park visitation experiences (Hall & Higham, 2005; Richardson & Loomis, 2005). For example, studies have revealed that weather often ranks high or highest among variables most important to outdoor recreationists (e.g., Hallo & Manning, 2009; Hallo, Manning, & Stokowski, 2009). Many resources used and enjoyed by park visitors are also weather and climate dependent. For instance, glaciers are a central feature at several frequently visited national parks (e.g., Kenai Fjords National Park, Glacier Bay National Park, and Glacier National Park). Similarly, rare species such as the Joshua tree at Joshua Tree National Park are endemic to certain climate zones within protected areas (Somerville, 1999). Climate can also influence fire regimes, pest infestations, and visitor facilities or attractions, and may ultimately affect visitation levels and visitor satisfaction (NPCA, 2009). With climate-related impacts expected to increase in future years (IPCC, 2009; NPCA, 2009; CCRP, 2010), concerns regarding climate-mediated effects on nature-based recreation will continue to rise (Stedman, Davidson, & Wellstead, 2005; Toth & Hizsnyik, 2008). Research is therefore needed to better understand nature-based recreationists' perceptions of, attitudes towards, and behavioral responses to climate change and resource impacts in parks (Manning, 2011).

Despite the potentially valuable contributions of social science data in natural resource managers' attempts to develop appropriate and effective strategies for eliciting public support, informing policy and planning decisions, and mitigating impacts on climate-sensitive resources (Semenza et al., 2008; Toth & Hizsnyik, 2008), researchers have noted that few investigations have explicitly accounted for perceptions of climate change and its perceived impacts (Buzinde, Manuel-Navarrette, Yoo, & Morais, 2010; Gossling, Scott, Hall, Ceron, & Dubois, 2012; Hall & Lew, 2009; Scott, Jones, & Konopek, 2008). Without adequate data regarding visitor perceptions and the effects of park-based climate change education and outreach on these perceptions, managers are missing a fundamental step in the provision of high quality outdoor recreation and environmental education experiences (Brownlee, Powell, & Hallo, 2012).

In U.S. national parks and protected areas, research integrating biophysical changes and social responses is especially relevant. Although the National Park Service (NPS) aims to educate visitors about global climate change and impacts, most park managers lack information about public awareness and perceptions (CCRS, 2010). Because effective environmental education relies on knowledge of pre-existing beliefs about a specific topic (Knudson, Beck, & Cable, 2003), managers need to develop a better understanding of the complex factors influencing visitors' opinions regarding climate change (Brownlee & Leong, 2011). Documented variations in visitor perceptions across geographic regions suggest that park managers and decision-makers should also recognize the value of site-specific information regarding climate change beliefs (Hulme, 2009). This study attempted to synthesize all of these research needs to explore strategies for assessing and responding to visitor perceptions of climate change at Great Sand Dunes National Park (GRSA), Colorado - a site that protects climate-sensitive resources and educates visitors about these features.

2.0 Methods and Analysis

2.1 Sampling Design

During the summer of 2011, researchers conducted a pilot study at GRSA, by intercepting visitors and inviting them to complete an online questionnaire ($N = 72$). The survey participants were park visitors over the age of 18 years. The primary survey locations were at the visitor center, and the main parking lot that grants access to Medano Creek and the dunes. These locations were used because park management identified them as providing the best opportunities to reach the most people. Participants were asked if they were willing to participate in a survey and if they agreed, were then asked to fill out a short information card that captured their name and email address. The participants were then told that they would be sent an email within the next 30 days and to please follow the link to complete the survey. Methodology was adapted from those outlined by Dillman (2007), and employed an initial email with a link to the survey. A total of three reminder emails were sent to potential respondents every 2 weeks after the initial contact. A total of 158 visitors were contacted and asked to complete the online survey, 72 completed it for a response rate of 46%.

2.2 Questionnaire Design and Analysis

For a guiding framework, the researchers selected an exploratory survey design (Vaske, 2008) to examine and begin to understand visitors' general global-level beliefs regarding climate change and site-specific perceptions of climate change at GRSA. The first portion of the survey examined the general climate change constructs of *occurrence* (i.e., is climate change happening) and *human influence* (i.e., is climate change caused by humans). Visitors' perceptions were evaluated on a seven-point Likert-type scale anchored with strongly disagree (1) to strongly agree (7). These multiple item measurements have demonstrated appropriate psychometric properties (e.g., fit indices, high convergent, discriminant, and predictive validity) when applied with outdoor recreationists in other NPS units and related protected areas (Brownlee & Hallo, 2011; Brownlee, 2012). In the second portion of the survey, researchers analyzed GRSA resources to identify three key features (Medano Creek, the alpine zone, and the sand dunes), which 1) are climate-influenced and/or climate-sensitive, 2) influence visitation behavior at GRSA, and 3) potentially impact the quality of the visitor experience at GRSA. Using seven-point Likert-type scales, researchers then evaluated how visitors perceive: 1) the *importance* of these resources to their GRSA visit (1 = not at all important, 7 = very important); 2) the *vulnerability* of each of these features to climate change (1 = not vulnerable at all, 7 = extremely vulnerable); and, 3) the *current influence* to each of these features from climate change (1 = not influenced at all, 7 = extremely influenced). Researchers also collected standard demographic information from each visitor using U.S. Census categories to further understand the characteristics of the sample. Researchers used standard calculations for leverage, kurtosis, and skewness to identify statistical outliers and to verify univariate and multivariate normality of the data (Tabachnick & Fidell, 2001). After confirming appropriate measurement qualities, researchers computed descriptive statistics (frequencies and distributions) using SPSS 18.0.

3.0 Results

3.1 Sample Description

The sample was almost even in respects to gender (56.5% males, 43.5% females) with a median age of 43. Concerning ethnicity, 89% of the sample was White, 7% Hispanic or Latino, and 4% African-American or Black. Approximately 42% of the sample reported possessing a Master's Degree or Professional Degree. All respondents reported that the United States was their country of primary residence. Regarding past-use history, 52.1% of the sample indicated it was their first visit to GRSA and 45.7% reported they were only visiting for one day. Most visitors (80.0%) reported that they had visited other NPS units within the past 12 months. The majority of respondents reported climbing the sand dunes (85.7%) and going to the visitor center (78.6%) at GRSA. Only 31.4% reported visiting Medano Creek during their time at GRSA.

3.2 Visitors' Global-level Climate Change Perceptions

Visitors reported strong beliefs that global climate change was currently happening ($M = 5.71$; $SD = 1.27$; Figure 1) but less certainty regarding the belief that human activities are influencing climate ($M = 4.49$; $SD = 0.99$; Figure 2). Specifically, 79% of the sample agreed global climate change was happening and 39% indicated that human actions influenced climate. The level of these global level beliefs was not significantly influenced by age, education, gender, first-time GRSA visit, or past visits to other NPS sites ($p > 0.05$). As expected, beliefs in human influence on climate and the occurrence of climate change were significantly correlated ($r = 0.86$; $p < 0.05$).

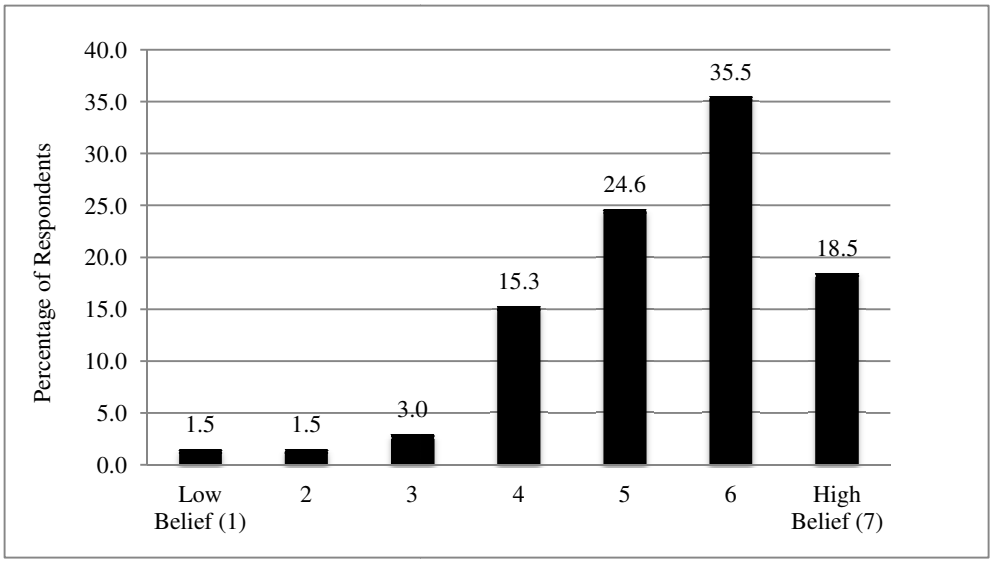

Figure 1. Great Sand Dunes National Park visitors' belief that climate change is occurring, Summer 2011 (n = 72). *Note:* Represents a composite score derived from multiple item measurements

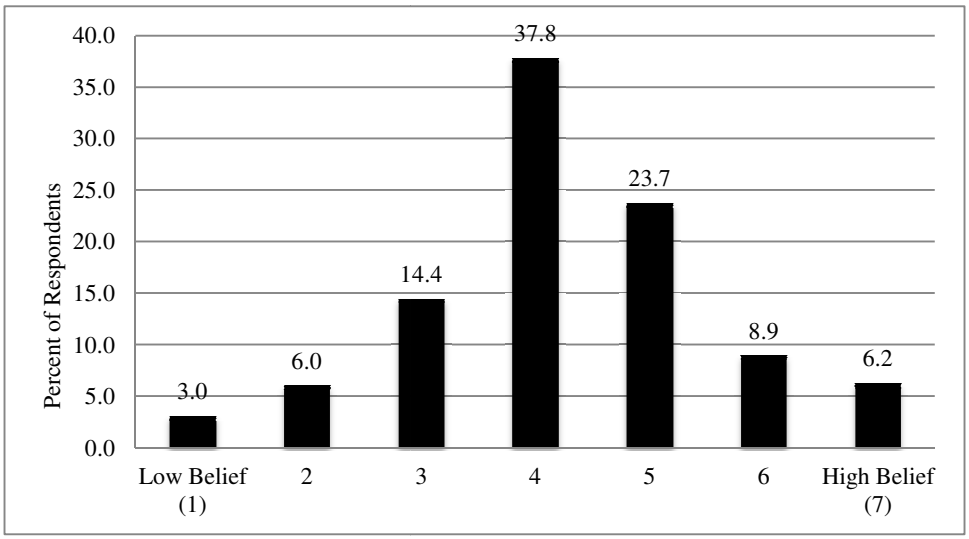

Figure 2. Great Sand Dunes National Park visitors' belief that climate change is influenced by human actions, Summer 2011 (n = 72). *Notes.* Represents a composite score derived from multiple item measurements

3.3 Visitors' Park-specific Climate Change Perceptions

According to GRSA visitors, the sand dunes were the most *important* resource during their visit (M = 6.59; SD = 0.73), the resource least *vulnerable* to climate change (M = 4.59; SD = 1.75), and the resource least *influenced* by climate change (M = 3.90; SD 1.63). Conversely, visitors reported the Medano Creek area as least *important* resource during their visit (M = 5.87; SD = 1.59), the resource most *vulnerable* to climate change (M = 5.78; SD = 1.48), and the resource most *influenced* by climate change (M = 4.95; SD = 1.66; Figure 3). Respondents who went to the visitor center, climbed the dunes, or recreated at Medano Creek did not possess different levels of perceived vulnerability or current impact ($p < 0.05$) from respondents who did not engage in these activities.

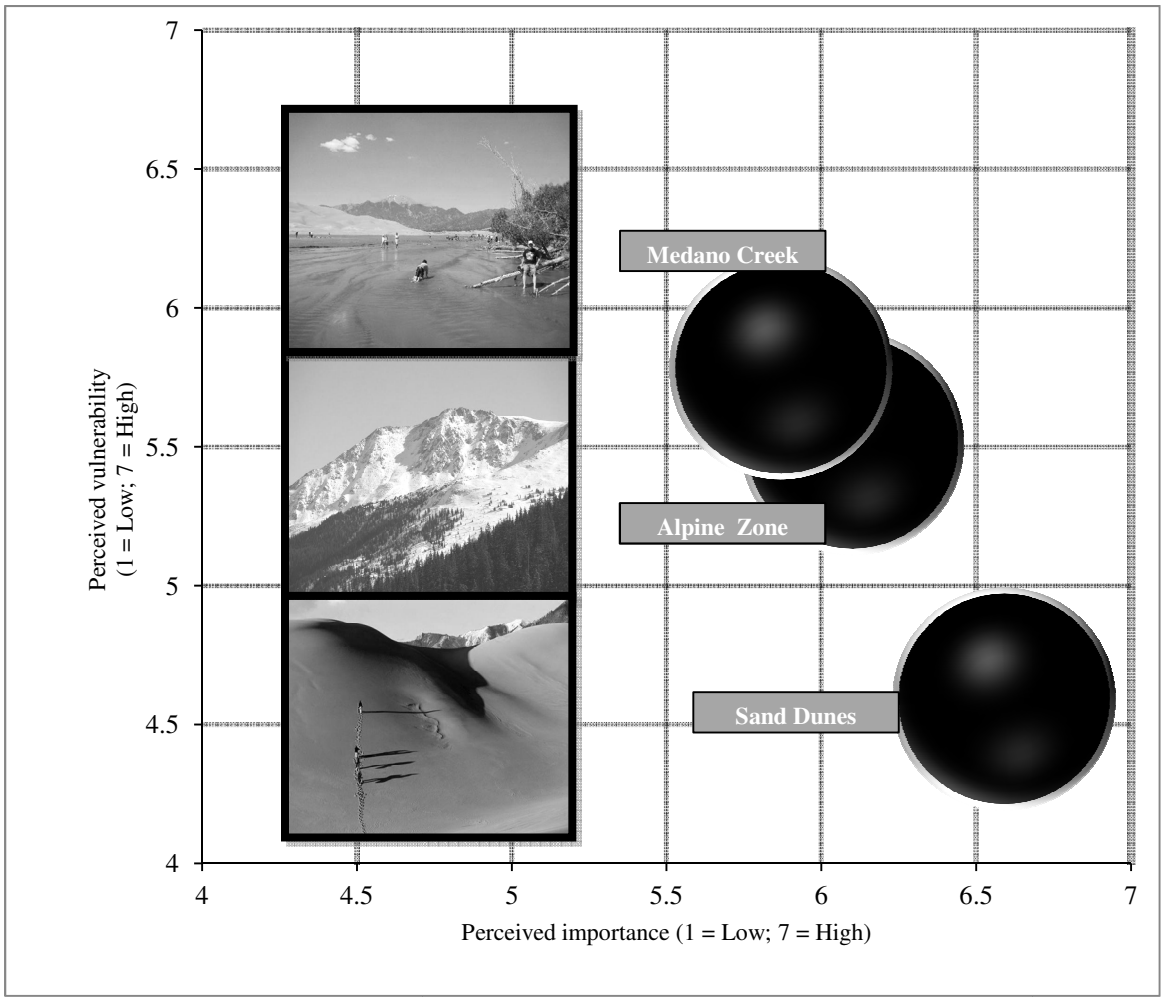

Figure 3. Mean (location of bubble) and aggregated and averaged standard deviation (size of bubble) for Great Sand Dunes National Park visitors' ratings of the level of importance and perceived level of climate change vulnerability for three major park resources: Medano Creek, Alpine Zone, and Sand Dunes, Summer 2011 (n = 72)

4.0 Discussion

Visitors' global and site-specific perceptions of climate change and climate-mediated impacts at GRSA highlight several interesting patterns and opportunities for programmatic growth. First, respondents' expressed a strong belief that climate change is occurring; however, the views reported by GRSA visitors do not accurately reflect the beliefs espoused by the typical U.S. resident. About 80% of GRSA visitors agreed with the statement that climate change was occurring; in the random national sample of the National Survey of American Public Opinion on Climate Change, the number was less than 66% (Rabe & Borick, 2010). Differences may partially reflect the distinct demographic characteristics of the typical GRSA visitor (e.g., white, older, well-educated, regular NPS visitor) – traits that are often observed among visitors at other NPS locations (Taylor, Grandjean & Anatchkova, 2011; Taylor, Grandjean, & Gramann, 2011).

Despite strong pre-existing beliefs in climate change occurrence, GRSA visitors reported mixed beliefs regarding humans' influence on climate change. Under 40% of respondents in the study agreed that humans are influencing climate, a number that closely mirrors the 1/3 of Americans who acknowledge anthropogenic causes of climate change (Rabe & Borick , 2010). A similar, unexpected disconnect between information exposure, education, and perceived responsibility for climate change has been observed in previous studies, with more informed respondents often feeling less responsible and less concerned about global warming (Kellstedt, Zahran, & Vedlitz, 2008). These counterintuitive results suggest that current climate change education and information distribution structures are inadequate. Researchers have therefore called for an emphasis on personally relevant connections that make climate change and its impacts more salient for individuals (Brownlee, Powell, & Hallo, 2012; Lorenzoni & Pidgeon, 2006).

Parks such as GRSA provide a perfect venue for interpreters and park staff to focus on climate change communication and help visitors understand the ways in which climate change can affect the natural resources they enjoy in a personal context (Hughes, Ham, & Brown, 2009). For instance, results of this study indicated that key resources in the park, particularly the sand dunes, were important to many visitors; however, visitors were less cognizant of the vulnerability of the dunes to climate change (e.g., changing climate affects micro-scale precipitation and weather patterns drive dune formation). In this case, park staff could develop interpretive media and programs that directly address the public's limited understanding of impacts on this climate-sensitive resource. This message may help visitors connect existing high beliefs in climate change occurrence with varying perceptions about the vulnerability of climate sensitive resources. When coupled with an explanation of climate change causes and potential solutions, similar place-based interpretive strategies that capitalize personally relevant contexts could increase awareness and enhance conceptualization of climate change among non-scientific audiences (Lorenzoni & Pidgeon, 2006). Building NPS institutional capacity for climate change education and interpretation through staff training and other mechanisms could also help to ensure consistent message delivery and increase public trust and support of government-sponsored climate change mitigation programs (Garfin et al., 2012; Rabe & Borick, 2010).

In conclusion, a growing body of literature confirms that successful adaptation to climate change in nature-based recreation areas will inevitably require a comprehensive integration of biophysical and social factors (Burkhardt, Carroll, & Lawhon, 2012). Through identification of visitors' pre-existing beliefs and attitudes and incorporation on cognitive and affective elements of the visitor experience at unique recreation destinations, this study illustrated how place-based research on climate change at parks such as GRSA could potentially influence public opinions regarding climate change and support for climate change management policies on much larger scales. However, it is important to note that the small sample size and climatic conditions during the sampling period (Medano Creek was not running at the time of data collection) need to be taken into account for future studies at GRSA. Future research could expand upon this exploratory framework to examine a larger sample and investigate visitor perceptions of climate change and climate-sensitive resources at GRSA and other sites within and outside of the NPS system in an effort to inform resource management decisions and develop targeted climate change visitor education programs.

5.0 Citations

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